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CMMI

Guidelines for Process Integration & Product Improvement

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Purpose:

The purpose of CMM Integration is to provide guidance for improving your organization's processes and your ability to manage the development, acquisition, and maintenance of products or services.

CMM Integration places proven approaches into a structure that helps your organization appraise its organizational maturity or process area capability, establish priorities for improvements, and implement these improvements.

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Representation: Continuous or Staged

Continuous: **If you choose the continuous representation for your organization, expect that the model will do the following:**

- **Allow you to select the order of improvement that best meets the organization's business objectives and mitigates the organization's areas of risk.**
- **Enable comparisons across and among organizations on a process area by process area basis or by comparing results through the use of equivalent staging.**
- **Allows improvements of different processes to be performed at different rates.**
- **Provide an easy migration from Electronic Industries Alliance Interim Standard (EIA/IS) 731 to CMMI.**
- **Afford an easy comparison of process improvement to International Organization for Standardization and International Electrotechnical Commission (ISO/IEC) 15504, because the organization of process areas is similar to ISO/IEC 15504.**

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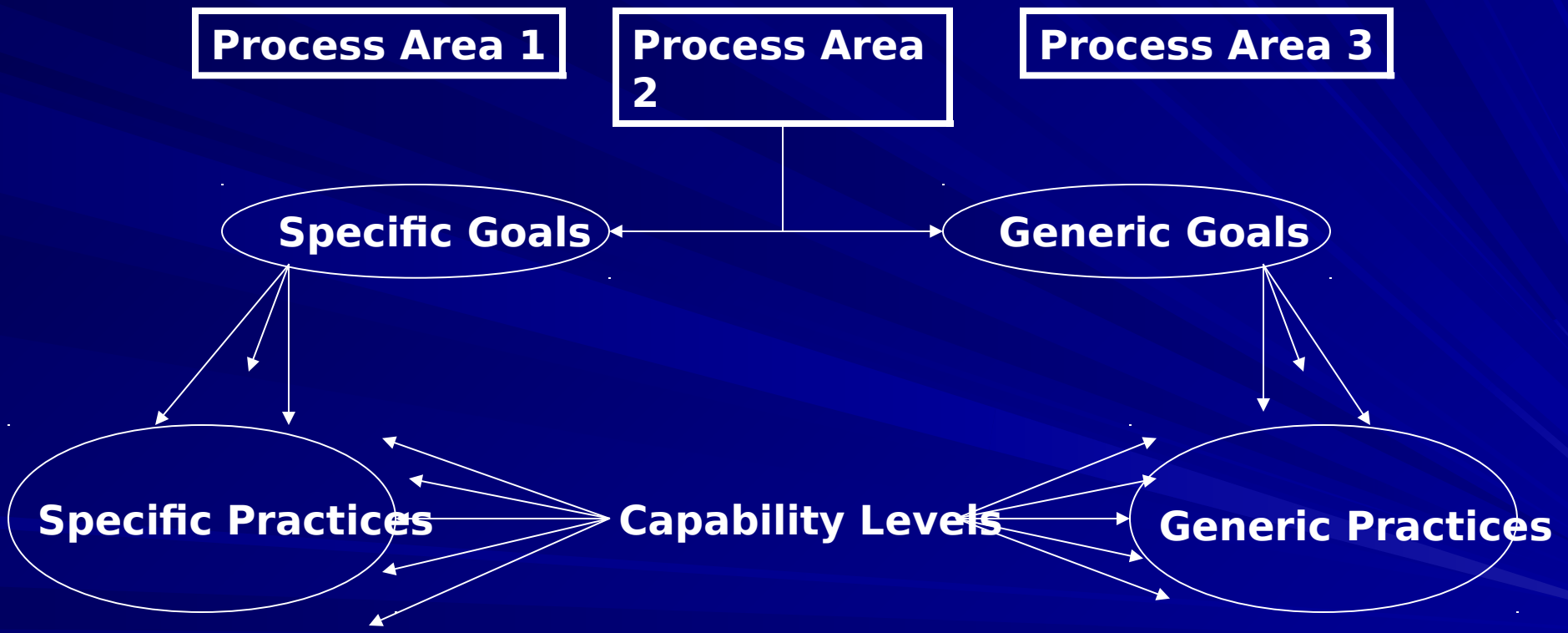
Continuous Structure:



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Representation: Continuous or Staged

Staged: If you choose the staged representation for your organization, expect that the model will do the following:

- **Provide a proven sequence of improvements, beginning with basic management practices and progressing through a predefined and proven path of successive levels, each serving as a foundation for the next.**
- **Permit comparisons across and among organizations by the use of maturity levels.**
- **Provide an easy migration from the SW-CMM to CMMI.**
- **Provide a single rating that summarizes appraisal results and allows comparisons among organizations.**

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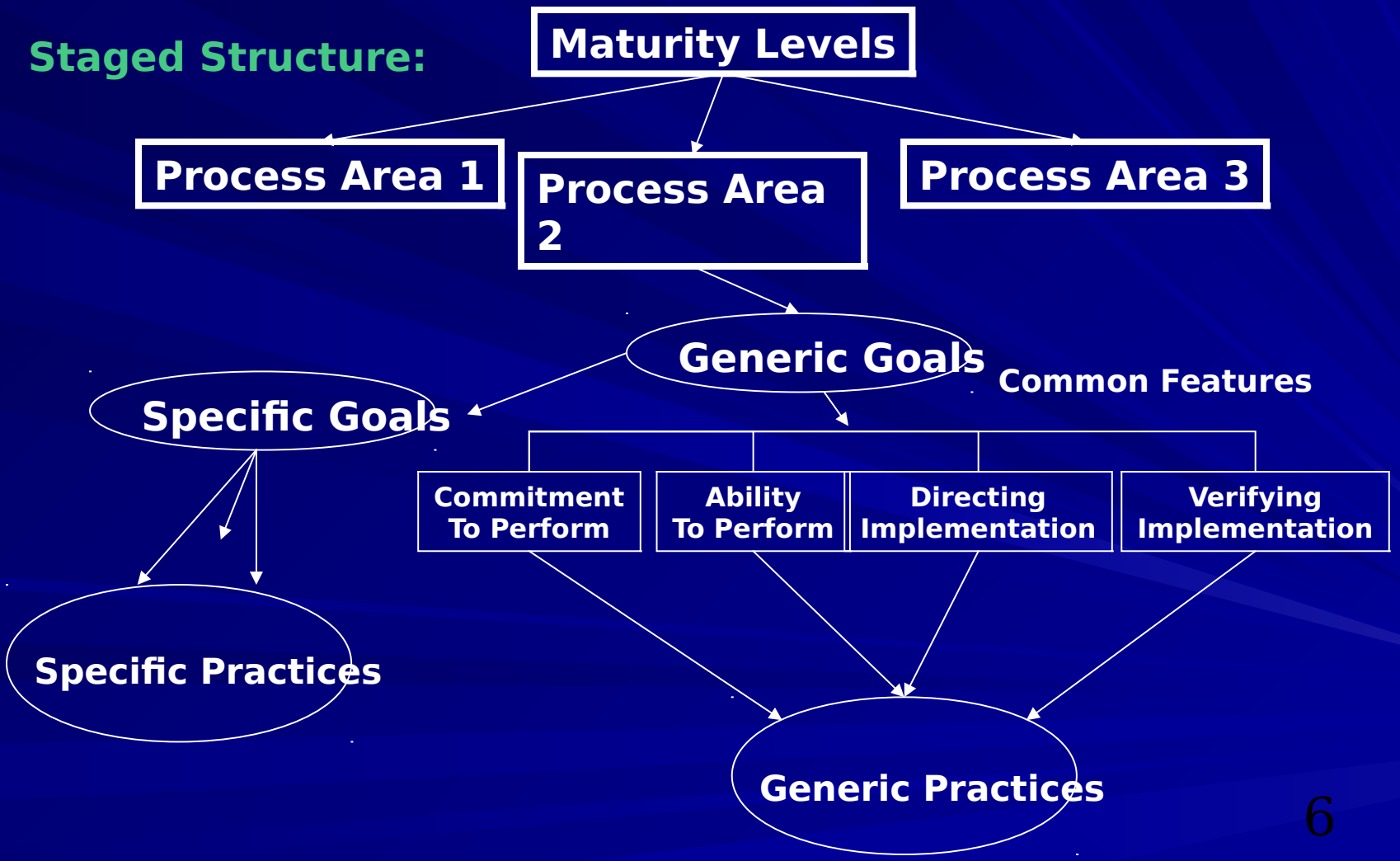
Staged Structure:



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CMMI Models:

The CMMI Product Suite contains and is produced from a framework that provides the ability to generate multiple models and associated training and appraisal materials.

These CMMI Models may reflect content from bodies of knowledge…

- **Systems Engineering (CMMI-SE)**
- **Software Engineering (CMMI-SW)**
- **Integrated Product and Process Development (CMMI-SE/SW/IPPD)**

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CMMI Models:

Use of a CMMI Model can help set….

- **Process Improvement Objectives and Priorities,**
- **Improve Processes, and**
- **Provide guidance for ensuring stable, capable, and mature processes.**

A selected CMMI Model can serve as a guide for improvements of organization processes.

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Capability Levels:

Belong to a *continuous representation*, and applies to an organization's process improvement achievement in individual process areas. These levels are a means for incrementally improving the process corresponding to a given process area. There are six capability levels, numbered 0 through 5.

Maturity Levels:

Belong to a *staged representation*, and applies to an organization's process improvement achievement across multiple process areas. These levels are a means of predicting the general outcomes of the next project undertaken. There are five maturity levels, numbered 1 through 5.

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Comparison of Capability and Maturity Levels		
Level	**Continuous Capability Levels**	**Staged Maturity Levels**
Level 0	Incomplete	N/A
Level 1	Performed	Initial
Level 2	Managed	Managed
Level 3	Defined	Defined
Level 4	Quantitatively Managed	Quantitatively Managed
Level 5	Optimizing	Optimizing

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Capability Levels:

Level 0. Incomplete

Level 1. Performed

Reaching capability level 1 for a process area is equivalent to saying you perform the process area, or more precisely, you are achieving the specific goals of the process area.

Level 2. Managed

Reaching capability level 2 for a process area is like saying you manage your performance of the process area.

That there is a plan for performing it, there are resources provided, responsibilities assigned, training on how to perform it, selected work products for performing the process area are controlled, etc.

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Capability Levels:

Level 3. Defined

Reaching capability level 3 for a process area assumes that there is an organizational standard process or processes that cover that process area that can be tailored to the specific need.

There are two points to remember;

- Tailoring may result in making no changes to the standard process.
- Each process area covers multiple activities, some of which are repeatedly performed.

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Capability Levels:

Level 4. Quantitatively Managed

Level 5. Optimizing

Reaching capability level 4 or 5 for a process area is conceptually feasible but may not be economical except, perhaps, in situations where the product domain has been very stable for an extended period of time.

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Characterized as a “Defined Process.” A defined process that is tailored form the organization’s tailoring guidelines, and contributes work products, measures, and other process-improvement information to the organizational process assets.

3: Defined

Critical distinction between a “managed” and “defined” is the scope of application of the process descriptions, standards, and procedures.

Characterized as a “Managed Process.” A performed process that is also planned and executed in accordance with policy, employs skilled people have adequate resources to product controlled outputs, involves relevant stakeholders; is monitored, controlled, and reviewed; and is evaluated for adherence to its process description.

2: Managed

Critical distinction between a “performed” and “managed” is the extent to which the process is managed.

Characterized as a “Performed Process.” a) Process that satisfies the specific goals for the process area. b) Supports and enables the work needed to produce identified output work products using identified input work products.

1: Performed

Critical distinction between “incomplete” and “performed” is that a performed process satisfies all of the specific goals of the process area.

An incomplete process that is either not performed for partially performed. One or more of the specific goals of the process are not satisfied.

0: Incomplete

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Characterized as a "Optimizing Process." a) A quantitatively managed process that is changed and adapted to meet relevant current and projected business objectives. c) A process that focuses on continually improving the process performance through both incremental and innovative technological improvements. c) Process improvements that would address root causes of process variation and measurably improve the organization's processes are identified, evaluated, and deployed as appropriate.

5: Optimizing

Critical distinction between a "Quantitatively" and "Optimizing" is that the optimizing process is continuously improved by addressing common causes of process variation.

Characterized as a "Quantitatively Managed Process." a) Process that is controlled using statistical and other quantitative techniques. b) Quantitative objectives for quality and process performance are established and used as criteria in managing the process. c) The quality and process performance are understood in statistical terms and are managed throughout the life of the process.

4: Quantitatively Managed

Critical distinction between "Defined" and "Quantitatively" is the predictability of the process performance. The term "Quantitatively Managed" implies using appropriate statistical and other quantitative techniques to manage the performance of one or more critical subprocesses of a process so that the future performance of the process can be predicted. A "Defined Process" only provides qualitative predictability.

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Maturity Levels:

Level 1. Initial

At maturity level 1, processes are usually ad hoc and chaotic. The organization usually does not provide a stable environment to support the process. Success in these organizations depends on the competence and heroics of the people in the organization and not on the use of proved processes. In spite of this chaos, maturity level 1 organizations often produce products and services that work; however, they frequently exceed their budgets and do not meet their schedules.

Levels 2 through 5

Levels 2 through 5 us the same terms as capability

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Categories of CMMI Process Areas:

1. Process Management

- **Scope.** Process Management process areas contain the cross-project activities related to defining, planning, resourcing, deploying, implementing, monitoring, controlling, appraising, measuring, and improving processes.

- **Process Areas.**

  - Organizational Process Focus (OPF)
  - Organizational Process Definition (OPD)
  - Organizational Training (OT)
  - Organizational Process Performance (OPP)
  - Organizational Innovation and Deployment

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Categories of CMMI Process Areas:

2. Project Management

- **Scope.** Project Management process areas cover the project management activities related to planning, monitoring, and controlling the project.
- **Process Areas.**
  - Project Planning (PP)
  - Project Monitoring and Control (PMC)
  - Supplier Agreement Management (SAM)
  - Integrated Project Management (IPM)
  - Risk Management (RSKM)
  - Integrated Teaming (IT)
  - Quantitative Project Management (QPM)

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Categories of CMMI Process Areas:

3. Engineering

- **Scope.** Engineering process areas cover the development and maintenance activities that are shared across engineering disciplines (e.g., systems engineering and software engineering).
- **Process Areas.**
  - Requirements Development (RD)
  - Requirements Management (REQM)
  - Technical Solution (TS)
  - Product Integration (PI)
  - Verification (VER)
  - Validation (VAL)

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Categories of CMMI Process Areas:

4. Support

- **Scope.** Support process areas cover the activities that support product development and maintenance.
- **Process Areas.**
  - Configuration Management (CM)
  - Process and Product Quality Assurance (PPQA)
  - Measurement and Analysis (MA)
  - Organizational Environment for Integration (OEI)

Support

CONFIGURATION MANAGEMENT

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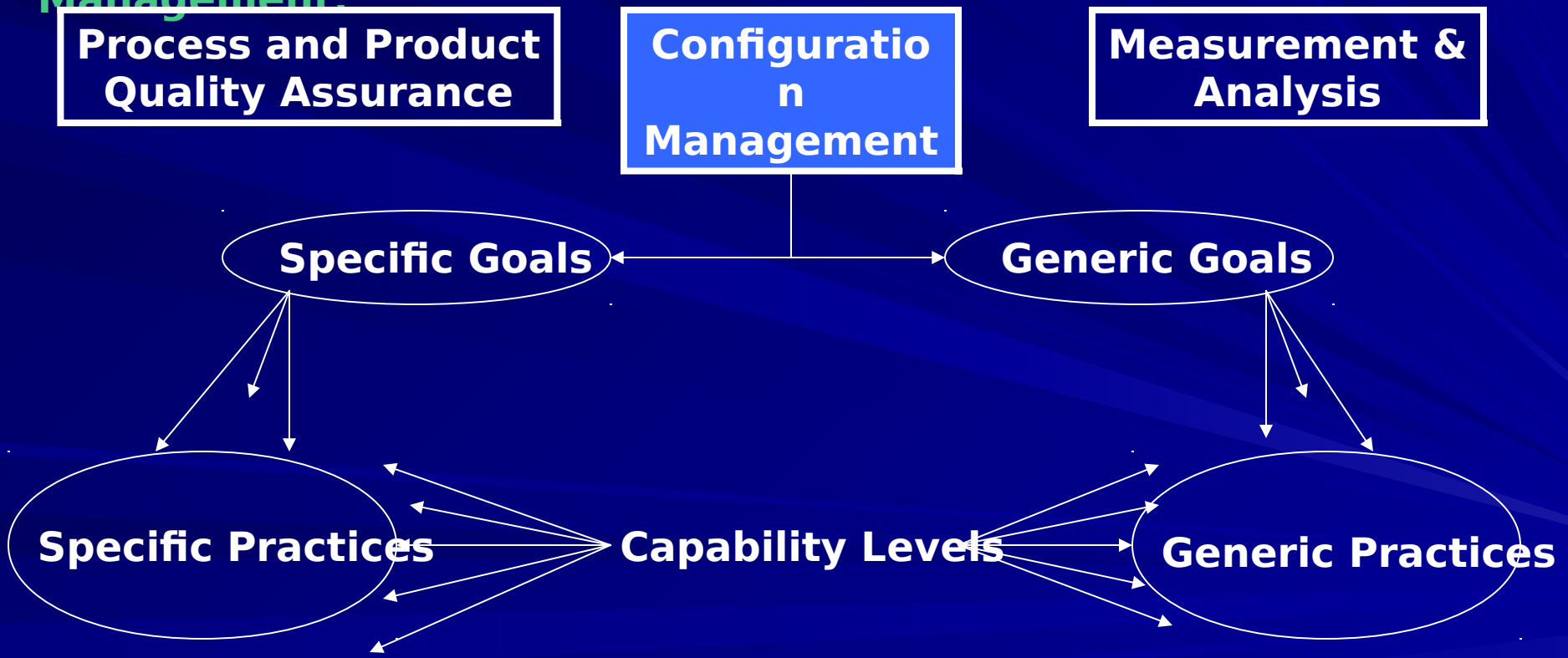
Support; Configuration Management;



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Purpose:

The purpose of Configuration Management (CM) is to establish and maintain the integrity of work products using…

- **Configuration Identification,**
- **Configuration Control,**
- **Configuration Status Accounting, and**
- **Configuration Audits.**

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Process Areas: **The Configuration Management Process area involves the following:**

- **Identifying the configuration of selected work products that compose the baselines at given points in time.**
- **Controlling changes to configuration items.**
- **Building or providing specifications to build work products from the configuration management system.**
- **Maintaining the integrity of baselines.**
- **Providing accurate status and current**

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Work Products:

The work products placed under configuration management include…..

- **The products that are delivered to the customer,**
- **Designated Internal work products,**
- **Acquired products,**
- **Tools, and**
- **Other items that are used in creating and describing these work products.**

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Examples of Work Products:

- Plans
- Process Descriptions
- Requirements
- Design Data
- Drawings
- Product Specifications
- Code
- Compilers
- Product Data Files
- Product Technical Publications

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Baselines: **Baselines provide a stable basis for continuing evolution of configuration items.**

An example of a baseline is an approved description of a product that includes internally consistent versions of requirements, requirement traceability matrices, design, discipline-specific items, and end-user documentation.

Baselines are added to the configuration management system as they are developed. Changes to baselines and the release of work products built from the configuration management system are systematically controlled and monitored via the configuration control, change management, and configuration auditing functions of configuration management.

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Support; Configuration Management;

Process and Product Quality Assurance

Configuration Management

Measurement & Analysis

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Specific Goals:

SG 1: Establish Baselines

Baselines of identified work products are established.

SG 2: Track and Control Changes

Changes to the work products under configuration management are tracked and controlled.

SG 3: Establish Integrity

Integrity of baselines is established and maintained.

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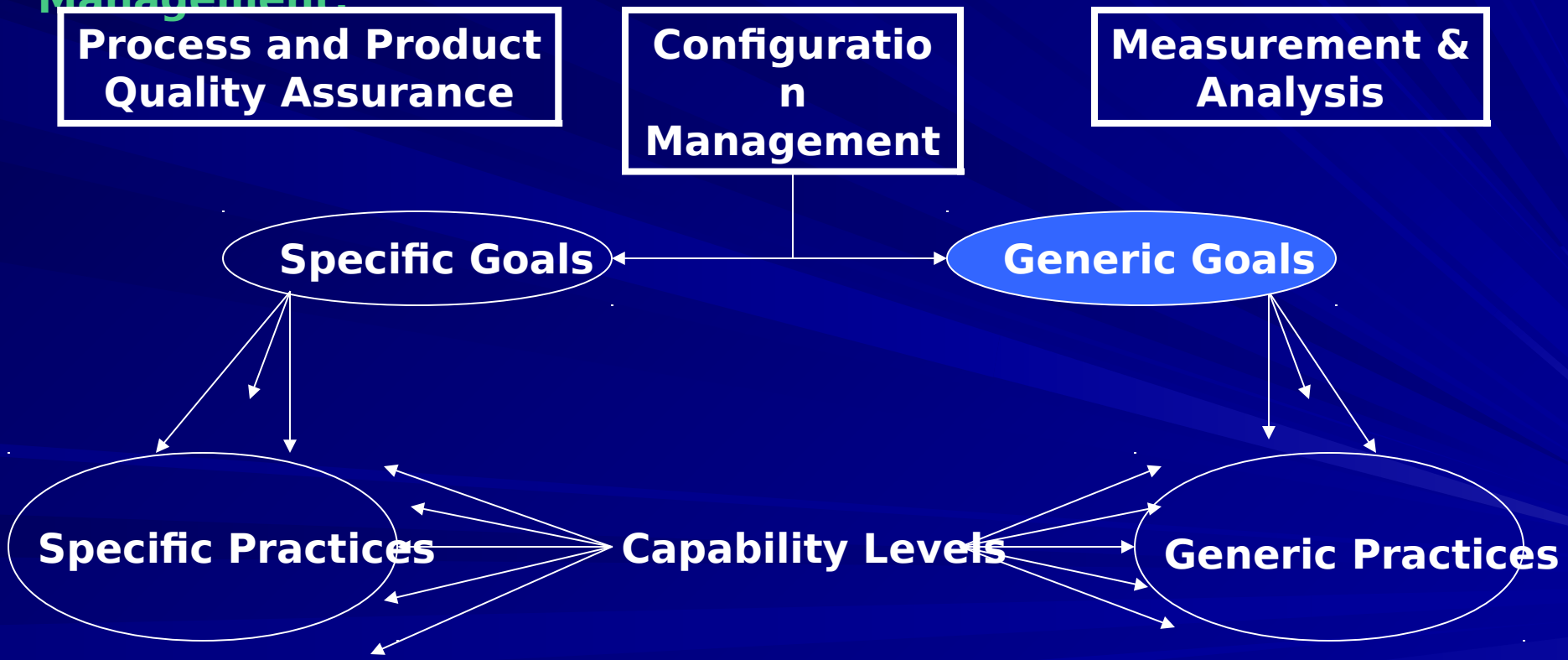
Support; Configuration Management;



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Generic Goals:

GG 1: Achieve Specific Goals

The process supports and enables achievement of the specific goals of the process area by transforming identifiable input work products to produce identifiable output work products. (Continuous Only)

GG 2: Institutionalize a Manage Process

The process is institutionalized as a managed process.

GG 3: Institutionalize a Defined Process

The process is institutionalized as a defined process. (Staged only [does not apply to ML 2], but does apply for ML 3 and above)

GG 4: Institutionalize a Quantitatively Managed Process

The process is institutionalized as a quantitatively managed process. (Continuous Only)

GG 5: Institutionalize an Optimizing Process

The process is institutionalized as an optimizing process. (Continuous Only)

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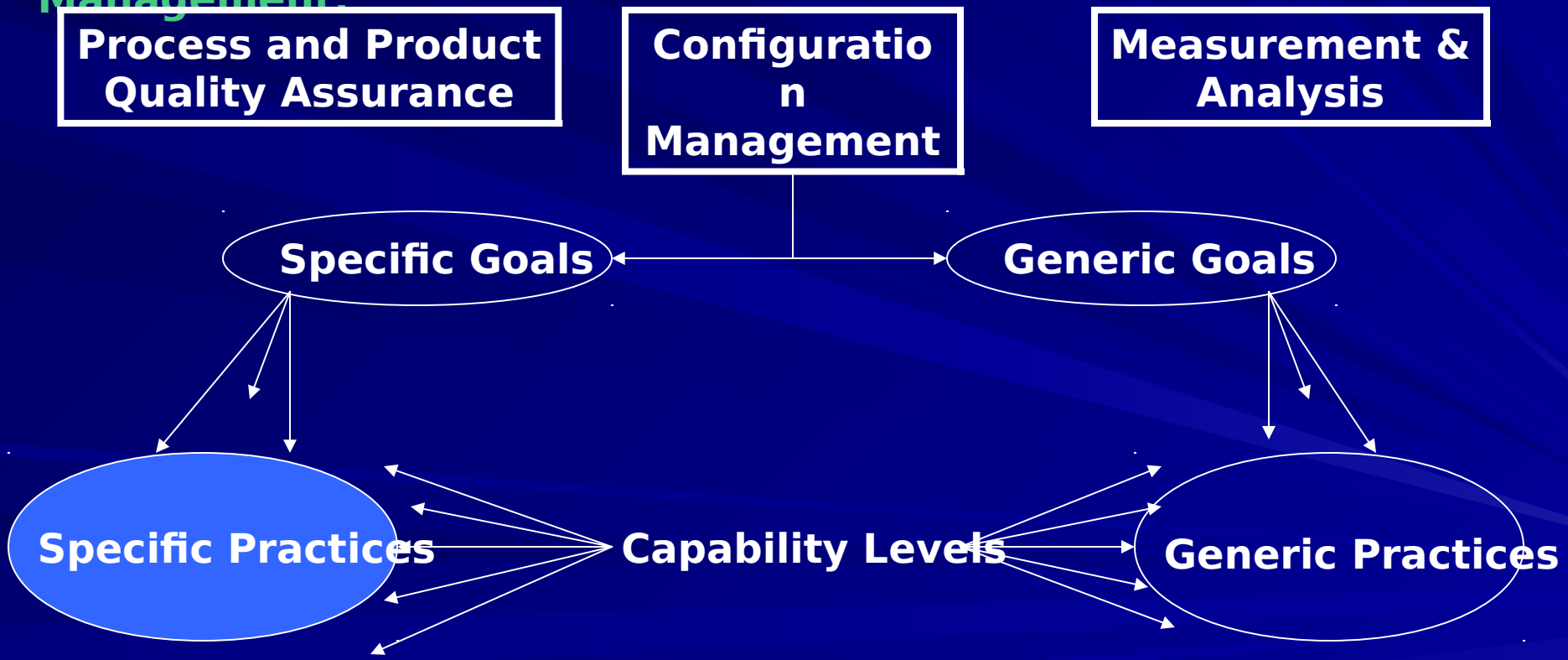
Support; Configuration Management;



Specific Practices by Goal: SG 1 "Establish Baselines"

SP 1.1-1: Identify Configuration Items

Identify the configuration items, components, and related work products that will be placed under configuration management.

- **Subpractices…**

1. **Select the configuration items and the work products that compose them based on documented criteria.**
2. **Assign unique identifiers to configuration items.**
3. **Specify the important characteristics of each configuration item.**
4. **Specify when each configuration item is placed under configuration management.**
5. **Identify the owner responsible for each configuration item.**

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SP 1.2-1: Establish a Configuration Management System

Establish and maintain a configuration management and change management system for controlling work products.

- **Subpractices…**

1. **Establish a mechanism to manage multiple control levels of CM.**
2. **Store and retrieve configuration items in CM system.**
3. **Share and transfer CIs between control levels within the CM system.**
4. **Store and recover archived versions of CIs.**
5. **Store, update, and retrieve CM records.**
6. **Create CM reports from the CM system.**
7. **Preserve the contents of the CM system.**
8. **Revise the CM structure as necessary.**

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SP 1.3-1: Create or Release Baselines

Create or release baselines for internal use and for delivery to the customer.

- **Subpractices…**

1. **Obtain authorization form the CCB before creating or releasing baselines of configuration items.**
2. **Create or release baselines only from CIs in the CM system.**
3. **Document the set of CIs that are contained in a baseline.**
4. **Make the current set of baselines readily available.**

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Specific Practices by Goal: SG 2 "Track and Control Changes"

SP 2.1-1: Track Change Requests

Track change requests (CRs) for the configuration items.

- **Subpractices…**

1. **Initiate and record change requests in the change request database.**
2. **Analyze the impact of changes and fixes proposed in the CR.**
3. **Review CRs that will be addressed in the next baseline with those who will be affected by the changes and get their agreement.**
4. **Track the status of CRs to closure**

SP 2.2-1: Control Configuration Items

Control changes to the configuration items (CIs)

- **Subpractices…**

1. **Control changes to CIS throughout the life of the product.**
2. **Obtain appropriate authorization before changed CIs are entered into the CM system.**
3. **Check in and check out CIs from the CM system for incorporation of changes in a manner that maintains the correctness and integrity of the CIs.**
4. **Perform reviews to ensure that changes have not caused unintended effects on the baseline.**
5. **Record changes to CIs and the reasons for the changes as appropriate.**

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Specific Practices by Goal: SG 3 "Establish Integrity"

SP 3.1-1: Establish Configuration Management Records

Establish and maintain records describing configuration items.

- **Subpractices…**

1. **Record CM actions in sufficient detail so the content and status of each CI is known and previous versions can be recovered.**
2. **Ensure the relevant stakeholders have access to and knowledge of the configuration status of the CIs.**
3. **Specify the latest version of the baselines.**
4. **Identify the version of CIs that constitute a particular baseline.**

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SP 3.2-1: Perform Configuration Audits

Perform configuration audits to maintain integrity of the configuration baselines.

- **Subpractices…**

1. **Assess the integrity of the baselines.**
2. **Confirm that the configuration records correctly identify the configuration of the CIs.**
3. **Review the structure and integrity of the items in the CM system.**
4. **Confirm the completeness and correctness of the items in the CM system.**
5. **Confirm compliance with applicable CM standards & procedures.**

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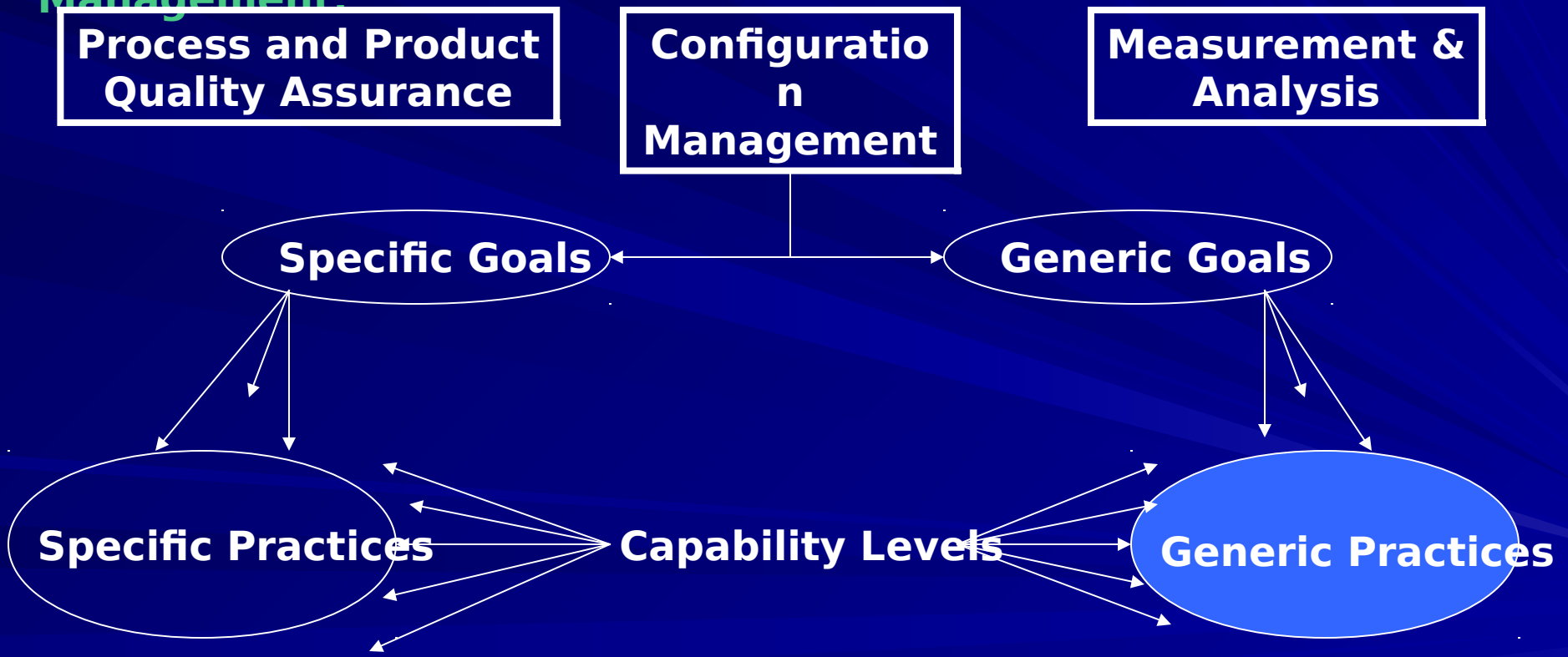
Support; Configuration Management;



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Generic Practices by Goal: GG 1 "Achieve Specific Goals"

GP 1.1: Perform Base Practices

Perform the base practices of the configuration management process to develop work products and provide services to achieve the specific goals of the process area.

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Generic Practices by Goal: GG2 "Institutionalize a Managed Process"

(Commitment to Perform)

GP 2.1: Establish an Organizational Policy

Establish and maintain an organizational policy for planning and performing the configuration management process.

(Ability to Perform)

GP 2.2: Plan the Process

Establish and maintain the plan for performing the configuration management process.

(Continued)

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Generic Practices by Goal: GG2 "Institutionalize a Managed Process"

GP 2.3: Provide Resources

Provide adequate resources for performing the configuration management process, developing the work products, and providing the services of the process.

GP 2.4: Assign Responsibility

Assign responsibility and authority for performing the process, developing the work products, and providing the services of the CM process.

GP 2.5: Train People

Train the people performing or supporting the CM process as needed.

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Generic Practices by Goal: GG2 "Institutionalize a Managed Process"

(Directing Implementation)

GP 2.6: Manage Configurations

Place designated work products of the CM process under appropriate levels of configuration management.

GP 2.7: Identify and involve Relevant Stakeholders

Identify and involve the relevant stakeholders of the CM process as planned.

GP 2.8: Monitor and Control the Process

Monitor and control the CM process against the plan for performing the process and take appropriate corrective actions.

Generic Practices by Goal: GG2 "Institutionalize a Managed Process"

(Verifying Implementation)

GP 2.9: Objectively Evaluate Adherence

Objectively evaluate adherence of the CM process against its process description, standards, and procedures, and address noncompliance.

GP 2.10: Review Status with Higher Level Management

Review the activities, status, and results of the CM process with higher level management and resolve issues.

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Generic Practices by Goal: GG3 "Institutionalized a Defined Process"

(Ability to Perform)

GP 3.1: Establish a Defined Process

Establish and maintain the description of a defined CM process.

(Directing Implementation)

GP 3.2: Collect Improvement Information

Collect work products, measures, measurement results, and improvement information derived form planning and performing the CM process to support the future use and improvement of the organization's processes and process assets.

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Generic Practices by Goal: GG4 "Institutionalized a Quantitatively Managed Process"

GP 4.1: Establish Quantitative Objectives for the Process

Establish and maintain quantitative objectives for the CM process that address quality and process performance based on customer needs and business objectives.

GP 4.2: Stabilize Subprocess Performance

Stabilize the performance of one or more subprocesses to determine the ability of the CM process to achieve the established quantitative quality and process-performance objectives.

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Generic Practices by Goal: GG5 "Institutionalize an Optimizing Process"

GP 5.1: Ensure Continuous Process Improvement

Ensure continuous improvement of the CM process in fulfilling the relevant business objectives of the organization.

GP 5.2: Correct Root Causes or Problems

Identify and correct the root causes of defects and other problems in the configuration management process.

Practice-to-Goal Relationship Table	
Continuous Representation	***Stage Representation***
SG 1 Establish Baselines SP 1.1-1 Identify CIs SP 1.2-1 Establish a CM System SP 1.3-1 Create or Release Baselines	SG 1 Establish Baselines SP 1.1-1 Identify CIs SP 1.2-1 Establish CM System SP 1.3-1 Create or Release Baselines
SG 2 Track and Control Changes SP 2.1-1 Track Change Requests SP 2.2-1 Control CIs	SG 2 Track and Control Changes SP 2.1-1 Track Change Requests SP 2.2-1 Control CIs
SG 3 Establish Integrity SP 3.1-1 Establish CM Records SP 3.2-1 Perform Configuration Audits	SG 3 Establish Integrity SP 3.1-1 Establish CM Records SP 3.2-1 Perform Configuration Audits
GG 1 Achieve Specific Goals GP 1.1 Perform Base Practices	**Required for Continuous Only**
GG 2 Institutionalize a Managed Process GP 2.1 Establish an Organizational Policy GP 2.2 Plan the Process GP 2.3 Provide Resources GP 2.4 Assign Responsibility GP 2.5 Train People GP 2.6 Manage Configurations GP 2.7 Identify and Involve Relevant Stakeholders GP 2.8 Monitor and Control the Process GP 2.9 Objectively Evaluate Adherence GS 2.10 Review Status with Higher Level Mgt.	GG 2 Institutionalize a Managed Process GP 2.1 Establish an Organizational Policy GP 2.2 Plan the Process GP 2.3 Provide Resources GP 2.4 Assign Responsibility GP 2.5 Train People GP 2.6 Manage Configurations GP 2.7 Identify and Involve Relevant Stakeholders GP 2.8 Monitor and Control the Process GP 2.9 Objectively Evaluate Adherence GS 2.10 Review Status with Higher Level Mgt.

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Practice-to-Goal Relationship Table	
Continuous Representation	***Stage Representation***
GG 3 Institutionalize a Defined Process GP 3.1 Establish a Defined Process GP 3.2 Collect Improvement Information	GG 3 Institutionalize a Defined Process GP 3.1 Establish a Defined Process GP 3.2 Collect Improvement Information ***(C/ML 3-5)***
GG 4 Institutionalize a Quantitatively Managed Process GP 4.1 Establish Quantitative Objectives for the Process GP 4.2 Stabilize Subprocess Performance	
GG 5 Institutionalize an Optimizing Process GP 5.1 Ensure Continuous Process Improvement GP 5.2 Correct Root Causes of Problems	

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